1204886

PATENT SPECIFICATION (11) 1 204 886

DRAWINGS ATTACHED

(21) Application No. 16706/67 (22) Filed 12 Sept. 1967

(31) Convention Application No. 585 023 (32) Filed 7 Oct. 1966 in

(33) United States of America (US)

(45) Complete Specification published 9 Sept. 1970

(51) International Classification ~~E 16 b 5/07~~

(52) Index at acceptance

E2S 3A

A4S 1M

(54) IMPROVED FASTENING DEVICE

(71) We, AMERICAN VELCRO, INC., a corporation organized and existing under the laws of the State of New Hampshire, United States of America, of Dow and Canal Streets, Manchester, State of New Hampshire, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved separable fastening device of the kind wherein two tape members have a plurality of hooking elements which of one member are resilient hooks extending from a base and of the other member are loops extending from a base. When the two kind of elements are placed in opposed relation they interengage in such manner that the members resist separation. Such a fastener, however, can be readily separated by applying force to open the hooks e.g. by peeling one of the tape members from the other.

The separate tape members can be formed from a sheet of woven fabric, each tape member having raised threads of synthetic material such as nylon wherein the loops of one tape member are cut adjacent their outer extremities to form the hooks but the loops of the other tape member remain uncut.

The preservation of the shape of the hooks is obtained by a thermal treatment appropriate for the particular synthetic material used.

Fastening devices of this kind are particularly useful when a flexible closure, as in closing devices for clothing is desired. A flexible fabric fastener of the above kind is not, however, useful for the expenditious installation of an object on a rigid surface because the adhesive bond required to satisfactorily affix each tape member of the flexible fastener to the rigid surface is ill suited to in situ operations. For example, the installation of wall panels requires a support which typically takes the form of wooden strips which are arranged in rib fashion and nailed to the wall. If the wooden strips were to be replaced by tape members of fastening devices of the above kind in which the bases were precoated with adhesive, time and convenience of installation would not be served because the installer would have to wait for the adhesive to set and the lack of rigidity of the tape members would present difficulties in alignment and placement. Moreover, if the tape members are adhesively bonded to the wall and the panels, difficulties such as varying values for temperature and humidity peculiar to each installation site impede achieving a uniform and permanent bond.

The spaced points of attachment provided by nails or tacks would not secure the entire under surface of the base of such a tape member to the wall or panel and it has been found that the lack of rigidity of the tape members will not permit them to support wall panels or any other bodies of moderate weights because the weights of such bodies will rend the tape members at their points of affixation to the wall and bodies. However, it was found that when each tape member of such a fastening device was provided with sufficient rigidity by bonding it to a plastics strip so that it could be nailed to a wall or other solid surface such as well panelling, the panel could be supported from the wall, but that a flush contact of each tape member could not be maintained with the solid surface because the impingement of the nails through the plastics strip on its centre line caused the edges of the strip to bow out from the wall. This in turn inhibited a proper mating of the hooks and loops because the surfaces of the two plastics strip sufficiently deviated from parallelism to prevent engagement of hook with loops at the centres of the strips.

According to the present invention there is provided an improved separable fastening device comprising first and second tape members each having a base and hooking elements formed of a flexible resilient material the elements of one member being loops and the

[Price 5s. 0d. (25p)]

other hooks characterized by the property that pressing the base supporting the hooks into face-to-face ralationship with the base supporting the loops will result in a large number of hooks interengaging a large number of loops to resist separaion but are readily separable by applying a force in a direction to open the hooks and the improvement comprising a resilient plastics strip having an arched cross section bonded to one of the tape member bases or respective said strips bonded to both tape member bases, the or each strip being bonded at its convex surface to the underside of the tape member base such that physical attachment of the strip to a flat surface by anchoring means extending through the strip and into the flat surface will cause he strip to flaten without bowing at its longitudinal edges, such that the convex surface is flattened to a planar surface the hooks or loops substantially covering said top surface.

According to a further aspect of the present invention there is provided a method of producing a tape member combined with a plastics strip for use in a fastening device as claimed in claim 1 which comprises extruding the plastics strip with concave and convex surfaces, cooling a predetermined length of the extruded strip, coating the underside of the tape member base with a thermoplastic adhesive, the opposite surface having the hooks or loops, heating the thermoplastic adhesive, bonding the adhesive coated surface of the tape member to the convex surface of the cooled strip, and passing the bonded tape member and strip after bonding through complementary concave-convex pressure rolls tailored to the desired extruded form of the plastics strip to be contiguous with the curved surfaces thereof whereby the adhesive bond is pressure sealed.

It was found that a tape such as is described in British Patent No. 927,828 may be used in combination with a plastics strip such as virgin high impact resilient vinyl having an arched cross section through its narrow dimension to hold objects to a rigid body such as a wall. If the object to be held in place which is connected to the arched plastic strip is itself a rigid body such as a wall panel it is an object of this invention to also provide said rigid object with a plastics strip which is bonded to, for example, a loop tape member for engagement with a hook tape member bonded plastics strip in place on the particular rigid surface. When the object to be held in place is a non-rigid body such as a cushion for attachment to furniture it was found that it was not always helpful to employ the plastics strip with a hook or loop tape member on the non-rigid body and that often a tape member alone which was sewn or otherwise attached to the non-rigid body would produce the most effective engagement with a plastics strip backed tape member attached to the rigid surface. It was further found that providing the plastics strip backed tape member with a slight curvature across the width of its base would prevent the edges of the strip from bowing outwardly when nails or other penetrating holding devices were used to attach the strip to the rigid surface. A curvature of the base of the vinyl strip such that the angle between the longitudinal edge of the strip and a plane drawn to include both longitudinal edges is at least 2° will provide a flush contact of the base of the plastics strip with the rigid surface to which it is attached. The arched base of the plastics strip therefore assures that upon physical transfixion to a rigid surface the hooking elements of the tape member bonded to the plastics strip will offer a parallel and therefore maximum engaging surface to the hooking elements of the member to be mated.

Preferred embodiments for the invention and a method for their production are described hereinbelow with reference to the accompanying drawings herein:

Fig. 1 is a fragmentary section of apparatus for making a fastening device member in accordance with the method of invention;

Fig. 2 is an enlarged fragmentary section taken along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary section taken along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary section of an embodiment of the fastening device being utilized in the installation of wall to wall carpeting; and

Fig. 5 is an enlarged vertical section of an embodiment of the new fastening device being utilized in the attachment of objects to a rigid surface.

Referring to Figs. 1—3, there is shown a particularly advantageous form of apparatus for practicing the continuous method of this invention. A tape fastener member 10, shown here for purposes of illustration as having a base and hooking elements in the form of hooks formed by raised threads of synthetic resin material is advanced from a storage spool (not shown) into a retaining bin 11. The purpose of the retaining bin 11 is to hold a sufficient amount of slack tape fastener member to allow an operator time to skive and join the end of the tape fastener member of one storage spool to the leading end of the tape fastener member of another storage spool and thus maintain the continuous nature of the method. It is helpful to this end to provide means for varying the rate of translation of tape fastener member 10 entering and leaving retaining bin 11.

As shown in Fig. 1, tape member 10 moves from retaining bin 11, ascends to a roller 12 and enters a trough 14 which is disposed below infra-red lamps 15. The under surface of tape member 10 which has been precoated, prior to its storage on a spool, with a thermoplastic adhesive faces and therefore is exposed to the

heat of the infra-red lamps 15 whose proximity to trough 14 is adjusted according to the rate of travel of tape member 10 through the trough. The greater the rate of travel, the closer is the placement of infra-red lamps 15 to trough 14 so that a heat activation range of the adhesive from 200 to 220°F is maintained.

The selection of the adhesive is restricted by the kind of surfaces to be bonded. In the example of Fig. 1 being described, the base of the tape member is nylon and an extruded strip to which the tape member is to be bonded is made of vinyl polymer. Thus, an adhesive seal must be effected between a nylon and a vinyl surface. One adhesive which can achieve the desired bond is a synthetic rubber resin, solvent type adhesive. This adhesive contains 20—28% by weight solids The solids are comprised of 40—60% by weight of a vinyl resin which is a copolymer of vinyl chloride and vinyl acetate. The solvent comprises a 50—50% mixture of acetone and methylethylketone. The ingredients are blended to form a liquid adhesive. The adhesive is applied to the under surface of the base of the tape element 10 and allowed to set by drying. This adhesive has a low melting point of about 170°F, and provides a bond strength of about 160 pounds per square inch.

Vinyl backing strip 21, preferably a virgin high impact semi-rigid vinyl, is extruded from conventional plastics extruder die 20 into a slightly arched shape and advanced through twenty feet of cool air from an air blower 22. Cooling the extrusion in an air stream for twenty feet sufficiently cures the vinyl strip 21 by shrinking and hardening to enable it to support tape member 10 as it comes in contact and is bonded to its convex surface. The rigidity acquired in the cooling also prevents the distortion of the strip in its passage under a roller 16 and through pressure rolls 17 and 18.

As shown in Figs. 1 and 2, the extruded vinyl backing strip 21 with tape fastener member 10 disposed thereon enters between the pair of opposed complementary pressure rolls 17 and 18 arranged one above the other about respective shafts 23 and 24 which are perpendicular to the line of travel of the extruded vinyl strip 21. The pressure rolls 17 and 18 are tailored to the desired extruded form of the plastics strip to be contiguous with the curbed surfaces thereof and are driven by variable speed means in opposite directions but at an equal rate. The width of the working surface of lower pressure roll 18 is equal to the outer width of vinyl strip 21, but the width of the working surface of pressure roll 17 is approximately equal to the width of the channel formed between longitudinal ridges 26 of the strip so that the width to be pressurized approximately coincides with the width of tape member 10 which is positioned in the channel defined by longitudinal ridges 26. The longitudinal ridges 26 are best seen in Fig. 3 but the width of the vinyl strip 21 upon which pressure is exerted as it passes through pressure rolls 17 and 18 is seen in Fig. 2.

The surface of upper pressure roll 17 is concave to the same degree as the complementary surface of lower pressure roll 18 is convex and this degree of curvature conforms to the degree of curvature of the arched vinyl strip. Thus, when a force perpendicular to shaft 23 is applied in the direction of shaft 24, pressure is transmitted to the contiguous interfaces of pressure rolls 17 and 18 and thence to the superimposed vinyl strip 21 and tape member 10 so that a complete and permanent bond of tape member 10 to the vinyl strip 21 is effected.

In the general mode of operation, the tape member 10, precoated with the thermoplastic adhesive, is advanced through the slack maintaining retainer bin 11 and pulled to trough 14 where the thermoplastic adhesive is heated to 200—220°F by the infra-red lamps 15, so that the adhesive is softened to a tacky state. At the same time, the vinyl strip 21 is extruded from the opposite direction from a plastics extruder 19 through the extrusion die 20 which imparts the slightly arched cross section and longitudinal ridges 26 to the vinyl strip 21. The extruded vinyl strip 21 is cooled by the air blower 22 for twenty feet prior to tangential engagement by tape member 10 whose path intercepts the path of vinyl strip at roller 16 which bonds the underside of the base of the tape member to the convex surface of the strip 21. The bond of the tape member 10 to vinyl backing strip 21 is pressure sealed and thus made permanent by simultaneous passage through the concave-convex pressure rolls 18 and 17. The width of the tape member is the same as the width of the channel in the strip between the ridges so that the hooks and loops substantially cover the top surface of the strip between the ridges 26. Preferably the height of the longitudinal ridges does not exceed the height of the hooking elements of the tape member.

An important feature of this method is that the tangential engagement of the tape member 10 to the vinyl strip 21 is designed to occur at the position where the extrusion has cooled to a rigidity sufficient to withstand the deforming force of pressure rolls 17 and 18 and the activated thermoplastic adhesive on the base of tape member 10 is tacky. It has been found that laying the adhesive coated tape element onto the non-cooled extruded vinyl as closely as possible to the extrusion die 20 produced a perfect bond when the pressure of pressure rolls 17 and 18 was applied but distortion of the end product also resulted because the vinyl was still warm and lacked sufficient rigidity to withstand the stress of the pressure rolls. The present method permits the permanent

continuous in situ bonding of the tape member 10 to the vinyl strip 21 by providing sufficient cooling from air blower 22 to shrink and harden the vinyl strip 21 and bringing it into tangential engagement with tape member 10 after the thermoplastic adhesive coated on its base has achieved a tacky condition and before passage through the concave-convex pressure rolls 17 and 18.

The product of the aforementioned method is shown in Fig. 3. It comprises the resilient vinyl strip 21 having an arched cross section through its narrow dimension and a uniformly thick base and the longitudinal raised ridges 26 disposed along the base near the edges of its narrow dimension. In Fig. 3 the arched vinyl strip 21 is shown to be slightly concave exteriorly with the angle between a plane A—A drawn include opposite longitudinal marginal edges and the concave surface of the strip being about 2.3° so that the strip has a concave base surface and a convex top surface. When the vinyl strip is attached by anchoring means (e.g. nails) extending through the strip on its centre line to a flat rigid surface with the base surface facing the rigid surface, the anchoring means will cause the strip to flatten without bowing at its longitudinal edges such that the concave surface is flattened to a planar surface. The flattened concavity continues to exert a force which impinges the edges of vinyl strip 21 against the flat rigid surface and consequentially offsets the tendency of the edges of the vinyl strip 21 to curl outwardly toward the centre of the strip.

This tendency to curl towards the centre of the vinyl strip especially around the points of transfixion to the flat rigid surface; is further reduced by the longitudinal rigidity afforded by ridges 26.

The tape member 10 comprises a base of fabric material 28 and a plurality of flexible resilient interengaging hooking elements formed by raised threads. These hooking elements can comprise either hooks 29 or loops 30. The hooks 29 are best seen in the embodiment of Fig. 3. In the preferred embodiment, the base is made of a woven synthetic resin material such as nylon. The hooks or loops are also in the preferred embodiment made of synthetic resin material which is interwoven with the base 28. Other materials can be substituted for the base and the hooks, as, for example, threads of fine wire; or the hooking elements could be made by some method other than weaving, such as a continuous casting operation.

The loops 30 are best seen in the embodiment of Fig. 5 in which they are shown as part of fastening device member 33 which is attached to a flat rigid surface 34 and which is adapted to be engaged by fastening device members 35 and 36 which are respectively attached to separate panels 31 and 32. Each fastening device member is made by the method described above with reference to Figs. 1 to 3.

The width of the fastening device members can vary and for purposes of illustration, in Fig. 5, fastening device member 33 is three times wider than either of fastening device members 35 and 36 to show one variation in which two panels are quickly secured in alignment to a rigid surface. Attachment of the fastening device members 35 and 36 having hooks 29 to fastening device member 33 having loops 30 is quick and sure. This is achieved by pressing the members 35 and 36 towards the member 33 so that the bases of the tape members 10 of the members 35 and 36 are in face to face relationship to the base of tape member 10 of member 33; this results in a large number of the hooks 29 engaging a large number of the loops 30 to resist separation in the length and width directions of the bases. Only light pressure contact is required between the interengaging hooks 29 and the loops 30 to effect their attachment. Although the exact number of engagements between hooks and loops is indeterminate, it has been found that the attachment thus made is secure and strong, particularly against the shearing action of the weight of panels 31 and 32 with respect to the rigid surface 34.

Fig. 4 shows an embodiment of the present invention wherein tape element 10 having loops 30 interwoven therein is not bonded to a vinyl strip 21 but is rather sewn along the edge positions of the under surface of carpet 37. Thus, Fig. 4 illustrates that the present invention is also useful in attaching non-rigid bodies such as carpets or convertible automobile covers to rigid surfaces by means of a tape member 10 attached to the flexible body and a fastening device member, denoted as 38 in Fig. 4, attached to the rigid surface and which member is made by the method described above with reference to Figs. 1 to 3.

The embodiment of the fastening device shown in Fig. 4 for use in securing wall to wall carpeting 37 in place is separated by peeling the carpet 37 away from the fastening device member 38. The ease of separation permitted by a device of the present invention will also be fully appreciated in connection with other non-rigid bodies such as furniture cushions and convertible top covers in automobiles. The separation of the bodies is permitted by reason of the resilient nature of the hooks 29. As the peeling takes place, the hooks 29 bend and open, permitting the loops 30 to disengage without breaking or being torn away from the base 10.

With respect to the particular embodiment of the present invention shown in Fig. 5 separation by peeling will be precluded because both hook and loop tape fastener device members are attached to rigid surfaces. However, separation can nevertheless be effected as deftly as in the case when one fastener

member is attached to a non-rigid body because the introduction of a letter-opener-type device will perform the same work of bending and opening the resilient hooks 29 as peeling the flexible tape member 10.

It can be seen that a fastening device in accordance with the present invention enables rigid and flexible objects to be easily installed. It similarly enables flexible objects to be installed quickly and with little skill. Both types of objects can be removed easily, one by simple peeling action, the other just as simply with the aid of a letter-opener-type device. Its applications are legion. There is great flexibility in the placement of the objects being installed.

Although it is preferred that the tape member having the loops be attached to the non-rigid objects to be installed, the tape member having the hooks can be substituted.

WHAT WE CLAIM IS:—

1. An improved separable fastening device comprising first and second tape members each having a base and hooking elements formed of a flexible resilient material the elements of one member being loops and the other hooks characterized by the property that pressing the base supporting the hooks into face-to-face relationship with the base supporting the loops will result in a large number of hooks interengaging a large number of loops to resist separation but are readily separable by applying a force in a direction to open the hooks and the improvement comprising a resilient plastics strip having an arched cross section bonded to one of the tape member bases or respective said strips bonded to both tape member bases, the or each strip being bonded at its convex surface to the underside of the tape member base such that physical attachment of the strip to a flat surface by anchoring means extending through the strip and into the flat surface will cause the strip to flatten without bowing at its longitudinal edges, such that the convex surface is flattened to a planar surface the hooks or loops substantially covering said top surface.

2. A fastening device as recited in claim 1 wherein the base of the first tape member comprises a fabric with which a plurality of raised threads of synthetic resin material are interwoven and which provide said loops.

3. A fastening device as recited in claim 1 or 2, wherein the base of the second tape member comprises a fabric with which a plurality of raised threads of synthetic resin material are interwoven and which provide said hooks.

4. A fastening device as recited in any of claims 1 to 3, wherein the or each plastics strip is further defined by longitudinal ridges disposed along the length of and near the edges of the strip and which form a channel in which the tape member is bonded.

5. A fastening device as recited in claim 4 wherein the height of the longitudinal ridges does not exceed the height of the hooking elements of the tape member.

6. A method of producing a tape member combined with a plastics strip for use in a fastening device as claimed in claim 1 which comprises extruding the plastics strip with concave and convex surfaces, cooling a predetermined length of the extruded strip, coating the underside of the tape member base with a thermoplastic adhesive, the opposite surface having the hooks or loops, heating the thermoplastic adhesive, bonding he adhesive coated surface of the tape member to the convex surface of the cooled strip, and passing the bonded tape member and strip after bonding through complementary concave-convex pressure rolls tailored to the desired extruded form of the plastics strip to be contiguous with the curved surfaces thereof whereby the adhesive bond is pressure sealed.

7. A method according to claim 6 wherein the heating step is accomplished by a bank of infra-red lamps.

8. A method as described in claim 6 or 7, wherein the strip is extruded with longitudinal ridges near the edges of the strip.

9. A method as claimed in any of claims 6 to 8, wherein the coating step is performed prior to the storage of the tape members on spools.

10. A method as claimed in any of claims 6 to 9, wherein the continuous nature of the process is maintained by skiving and joining the end of the tape member on one spool with the end of the tape member on the next spool and feeding sufficient amount of slack tape member into a retaining bin prior to the skiving and joining to permit completion of the skiving and joining operations.

11. A method according to any of claims 6 to 10, comprising bringing the plastics strip after the cooling into tangential engagement with the tape member having its adhesive in a tacky condition.

12. A combined tape member and backing therefor when produced by the method as claimed in any of claims 6 to 11.

13. A fastening device substantially as hereinbefore described with reference to the accompanying drawing.

14. A method of producing a tape member combined with a plastics strip, substantially as hereinbefore described with reference to the accompanying drawing.

15. A combined tape member and plastics strip, substantially as hereinbefore described with reference to the accompanying drawing.

1204886 COMPLETE SPEC
1 SHEET This drawing is a re
the Original on a r

FIG. 2

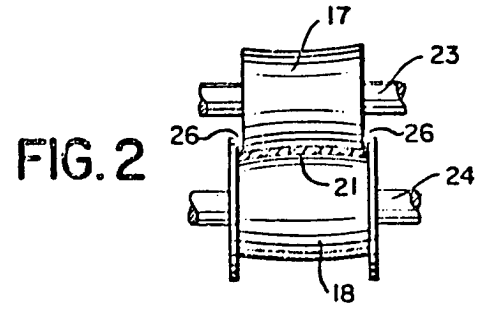


FIG. 1

FIG. 4

FIG. 3

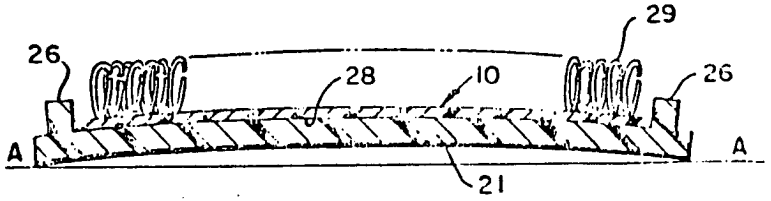
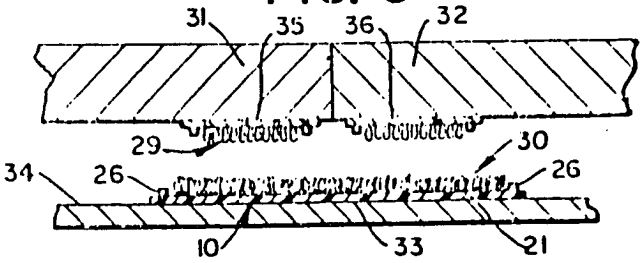


FIG. 5



CRUIKSHANK & FAIRWEATHER,
Chartered Patent Agents,
29 St. Vincent Place, Glasgow C.1.
Agents for the Applicants.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1970.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.